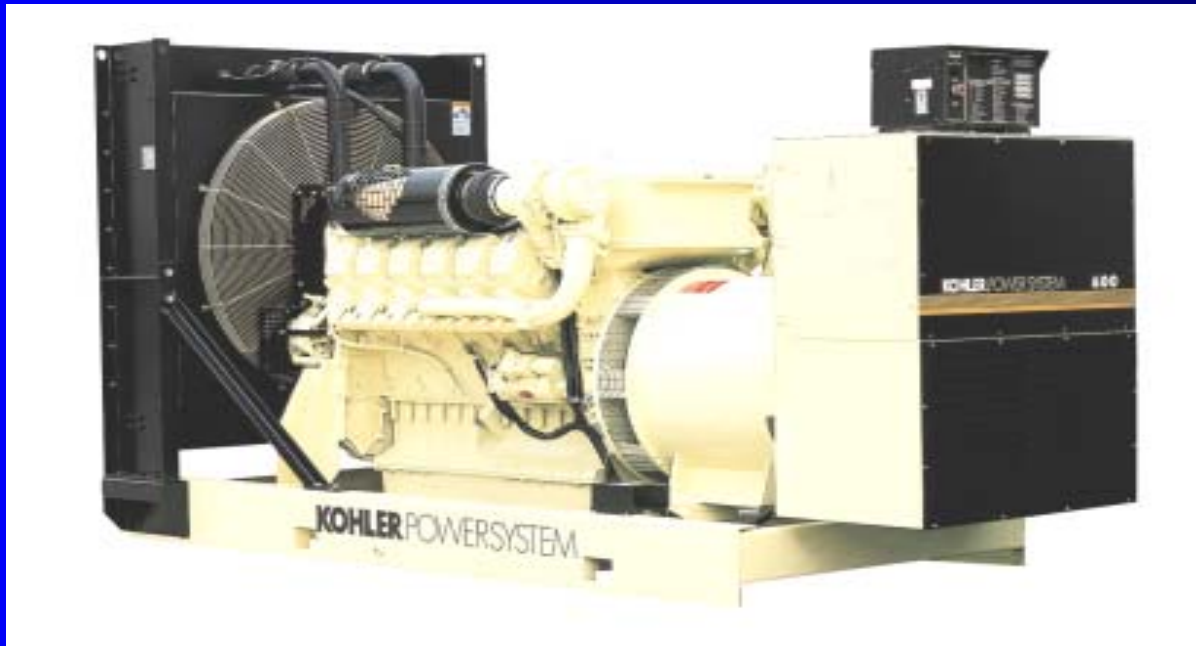


Reciprocating Engines

Installation and Operation



DIESEL

GAS

INDUSTRIAL/MOBILE

GENERATOR CONTROLS

TRANSFER SWITCHES

PARALLELING SWITCHGEAR

UPS

WIRELESS MONITORING

PACKAGING

APPLICATIONS:

- **STANDBY POWER**
 - **HOME**
 - **FACTORIES**
 - **HOSPITALS**
 - **NURSING HOMES**
 - **COMMUNICATIONS**
 - **DATA CENTERS**
 - **MUNICIPALITIES**
 - **AGRICULTURE**

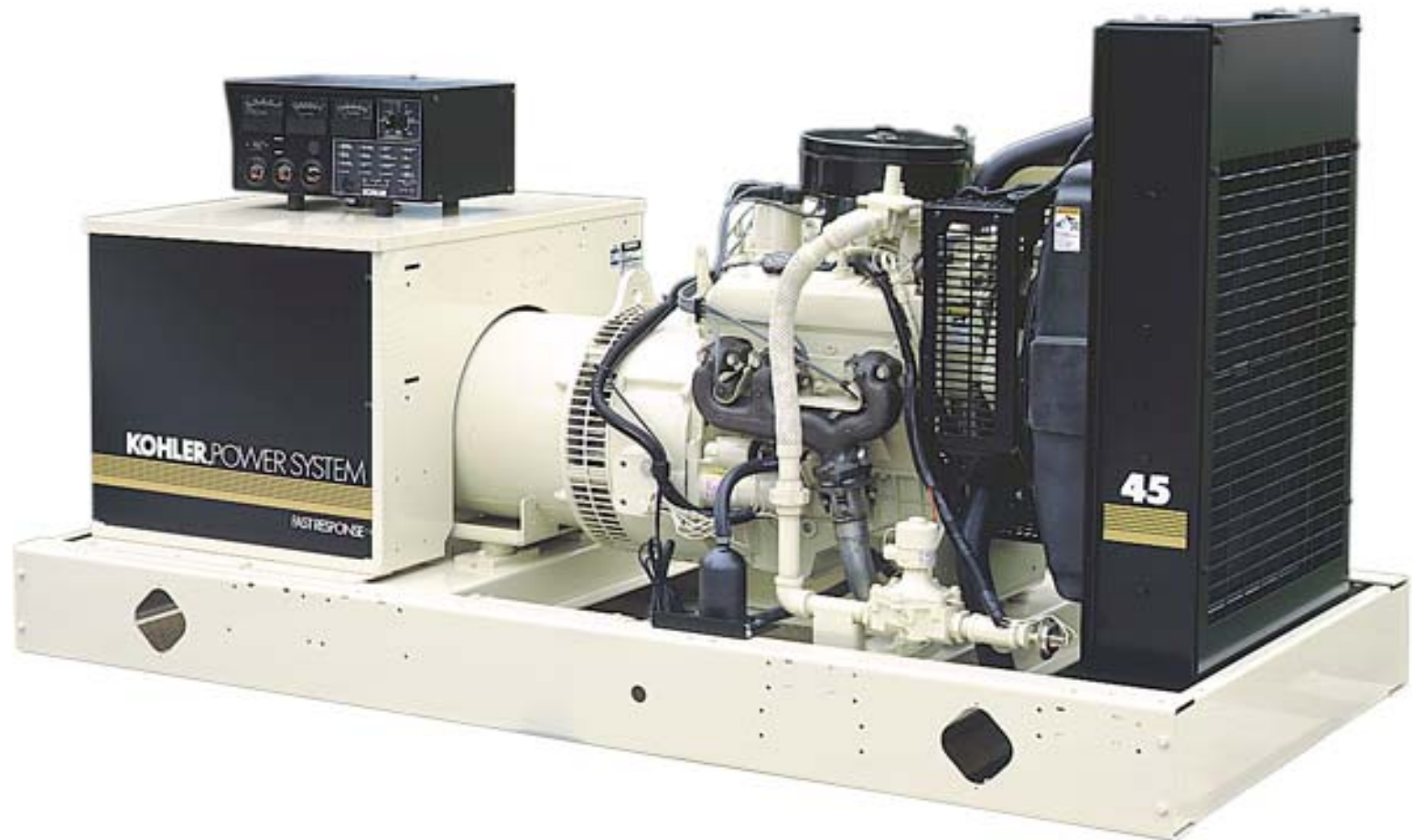
APPLICATIONS:

- **DISTRIBUTED GENERATION**
- **PRIME POWER**
- **CO-GENERATION**

Diesel Sets



Gas Sets



Trailer Mounted Sets



Sub-base fuel



Sound Housings



Enclosures



Enclosures



Enclosures



Enclosures



Full Generator Product Coverage





What does a generator controller do?

- Control
- Monitor
- Perform Diagnostics

Generator Controls

Market Drivers

- Customer Requirements
- Emissions
- Agency approvals
 - New UL 2200
 - NFPA 110

Engine Control Sensors

- Oil and Temperature Sensors
- SRS and TRS Sensors-timing signals
- Air temperature Sensors
- Coolant Temperature Sensor
- Oil Pressure Sensors
- Coolant level Sensors

Control System

- Precision Governing ($\pm 0.25\%$)
- Power
- Speed
- Startup
- Noise
- Emissions

Monitoring-ALTERNATOR

- Current (L1, L2, L3) $\pm 0.25\%$ accuracy.
- Frequency ± 0.5 accuracy
- KW, total per phase (L1, L2, L3) $\pm 0.5\%$
- KVA total per phase $\pm 0.5\%$ accuracy
- KVARs $\pm 0.5\%$ per phase
- Percent alternator duty level (actual load/standby rating).

Monitoring-Engine

- Oil Pressure
 - Coolant temp
 - VoltMeter -Battery
 - RPM
- **DDEC ENGINES**
 - Oil temp
 - Oil Level
 - Crankcase pressure
 - Coolannt pressure
 - Fuel Rate
 - Fuel TempFuel Use
Last Run
 - Ambient Temp

Communications

- MODBUS--Industry Standard for PLC and SCADA interface. Connects to MODBUS master.
- Interface for personal computer connected locally or via modem.
- Both software sets supplied on optional CD-ROM.

Control Functions

- Programmable engine start/cooldown
- Programmable starting aid
- Programmable load shed function
- High accuracy - 0.25% digital voltage regulator in software
- Alternator protection function

Monitoring

- Operation
 - Real time clock
 - Number of starts
 - Run time hours-loaded
 - Run time hours-unloaded
 - Number of days of operation

Monitoring

- Start date
- Date, duration and loaded/unloaded condition of last run
- Event Log - 100 entries
- Resettable maintenance records

Engine Function Shutdowns

- Displays messages not lights
- Causes generator shutdown
 - Engine functions
 - High coolant temperature
 - Low oil pressure
 - High oil temperature
 - Low coolant level
 - Overcrank and Overspeed
 - Locked rotor

Alternator and General Function Shutdowns

– Generator functions

- Alternator over voltage
- Alternator under voltage
- Underfrequency and Overfrequency
- Protection against overload and short circuit

– General functions

- Emergency stop
- Switch in off/reset position
- Auxiliary input closed - digital and analog

Engine Function Warnings

- Causes a warning
 - Engine functions
 - High coolant temperature
 - Low coolant temperature
 - Coolant gauge sensor loss
 - Low oil pressure
 - Oil pressure gauge sensor loss
 - Speed sensor signal loss
 - Low fuel (level or pressure)

Alternator Function Warnings

- Alternator functions
 - Generator running
 - Kilowatt overload for load shed
 - Overcurrent
 - Underfrequency

General System Warnings

– General functions

- Battery charger fault
- High battery voltage
- Low battery voltage
- Weak battery
- Ground fault(detection by others)
- Under frequency for load shed

Parts & Service Support

- U.S. Based Distributors
 - Hundreds of Dealers
- Provide 24 Hour Emergency Service
- Warranty Service
- Emergency Parts
- Maintenance Contracts
- Technical Assistance

Automatic Transfer Switches

- 40 to 4000 amp
- U. L. 1008 Listed
- Open Transition and Programmed Transition.
- Bypass Isolation
- Full Line of Accessories



Features

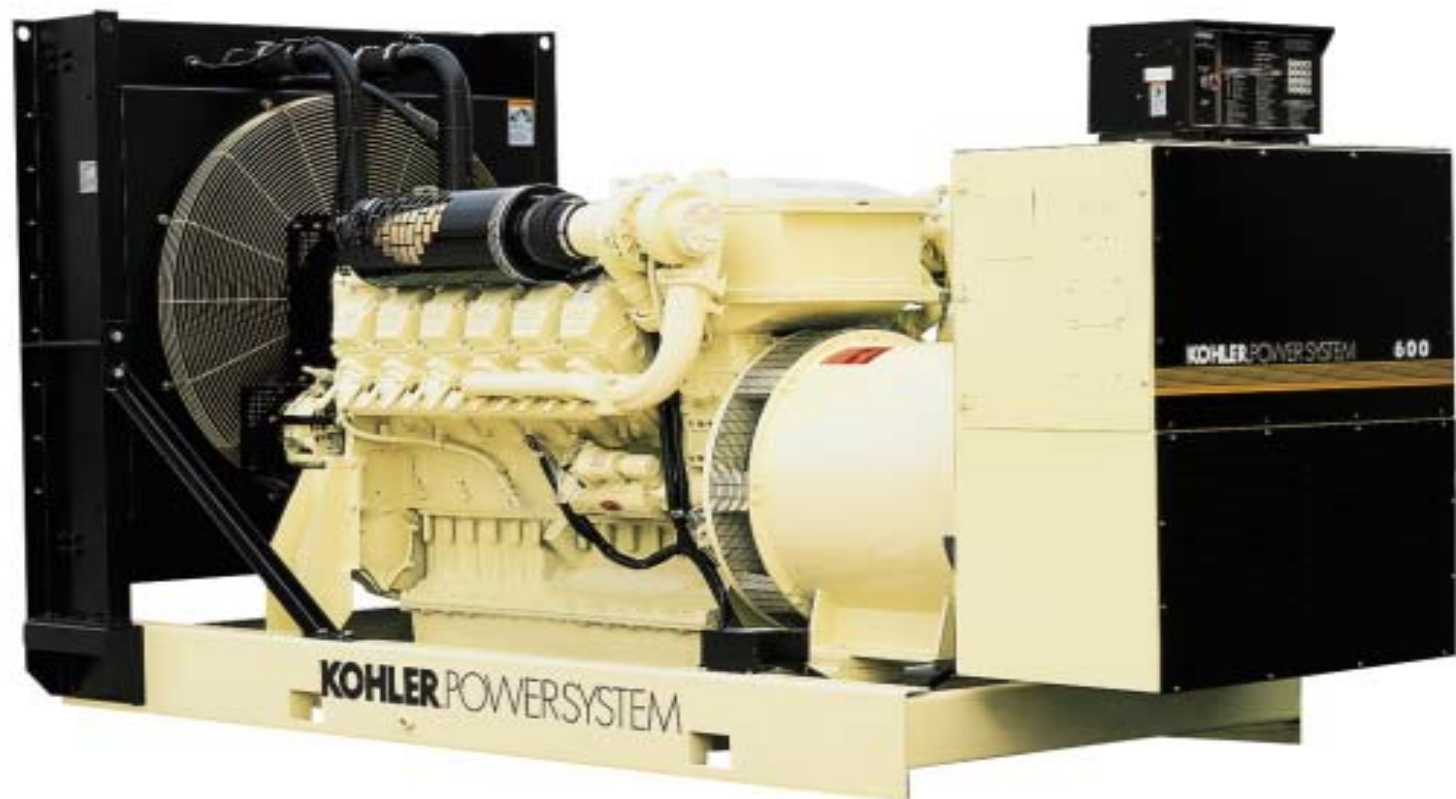
- Microprocessor Controller with simple user interface. Real time clock. Event log.
- In Phase monitor (default-disabled)
- Load/no load exercise functions.
- Gold flashed Start Contacts •Phase rotation sense.
- Broad range voltage sensing (208-600 VAC) 2% accuracy.
- Frequency sensing w/2% accuracy all phases both sources.

Codes and Standards

- UL 508 Std for Industrial Control Equipment
- UL 1008 Std. For Automatic Transfer Switch
- NFPA 70 Nat'l Electrical Code
- NFPA 99 Essential Electrical Systems of Health care facilities
- NFPA 110 Emergency & Standby Systems

Codes & Standards

- IEEE Standard 446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
- NEMA Standard 1C-10 for AC Automatic Transfer Switches.
- EN61000-4-4 Fast Transient Immunity Severity level 4.
- Applicable IEC Specifications for EMI/EMC immunity.



Page Owner: George Polson
Last Update: 10 JUL 2002

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NOTE:

This page does not apply to Series 50G or Series 60G engines.

Exercising Recommendations for Standby Generators - Diesel Engines

Effective January 1, 2000, changes were implemented in Joint Commission on Accreditation of Healthcare Organizations standard EC.2.14 regarding the testing of emergency power supply systems (EPSS).

These changes included the acceptance of NFPA-99-1999 Section 3-4.4.1.1(b) which calls for the EPSS to be tested a minimum of 12 times per year at intervals of no less than 20 days and no more than 40 days. Also effected were the requirements for the minimum acceptable load that should be applied to the EPSS during testing.

Prior to January 1, 2000, the requirements were to apply a minimum of 30% of the nameplate rating of the generator set or 50% of the greatest known load on the EPSS. They also required that the organization look for evidence of "wet stacking" of the exhaust system.

The technical committee for NFPA 110-1999 reviewed this and recommended three options for testing the EPSS. One – using building load, as long as the load is in excess of 30% of the nameplate rating of the EPSS. Two – operate the engine maintaining a minimum exhaust gas temperature as recommended by the engine manufacturer to prevent "wet stacking" of the exhaust. Three – using resistive load banks to perform an annual exercise with supplemental loads at 25% and 50% for 30 minutes each, followed by 75% load for 60 minutes for a total of two continuous hours. After completion of the annual test, they may test the EPSS monthly with all essential loads connected for 30 minutes establishing baseline temperatures for a healthy engine. If temperatures are consistently below the manufacturer recommendation then they will need to perform the annual load test.



CAUTION:

To avoid injury while performing the test or procedure, wear adequate eye, face protection, and heat-resistant gloves.

It is the recommendation of Detroit Diesel Corp. that the standby generator set is exercised under load at least once per month. In order to be sure that any condensation in the engine and generator has been eliminated, the set must be operated under load utilizing building load or resistive load banks, for a sufficient period of time to allow all operating temperatures to stabilize.

Operating a diesel engine with little or no load will not build up sufficient internal heat to raise engine, or generator temperature levels up to the point where accumulated condensation is driven off. In order to achieve normal operating temperatures within the engine and generator, the generator set should be operated at 30% load, or with engine exhaust temperatures as tabulated below.

Items to be Inspected, Serviced, Corrected, or Replaced as Necessary

Interval, hours	Air Cleaner	Air Compressor	Air System	Battery	Battery Charging Alternator	Check and Replace Nozzles	Coolant Level Sensor	Coolant Pump/ Inhibitor Level	Cooling System	Crankcase Breather	Crankcase Pressure	Cranking Motor	Drive Belts	Engine (Steam Clean)	Engine & Transmission Mounts	Exhaust System	Fan Hub	Fuel Filters	Fuel Lines & Flexible Hoses	Fuel Tank	Injector Nozzle Assembly	Lubricating Oil Filter	Lubricating Oil	Oil Pressure	Radiator	Thermostats & Seals	Valve Lash
100				X									X														
150	X	X						X										X									
500	X	X	X		X			X	X		X	X			X	X		X	X	X		X	X	X	X		
1000	X	X	X		X			X	X	X	X	X			X	X	X	X	X	X		X	X	X	X		
1500	X	X	X		X			X	X	X		X			X	X		X	X	X		X	X	X	X		
2000	X	X	X		X			X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X		
2500	X	X	X		X			X	X	X		X			X	X		X	X	X		X	X	X	X		
3000	X	X	X		X			X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
3500	X	X	X		X			X	X	X		X			X	X		X	X	X		X	X	X	X		
4000	X	X	X		X			X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	
4500	X	X	X		X			X	X	X		X			X	X		X	X	X		X	X	X	X		
5000	X	X	X		X			X	X	X	X	X			X	X	X	X	X	X		X	X	X	X		
5500	X	X	X		X			X	X	X		X			X	X		X	X	X		X	X	X	X		
6000	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X

Data Last Updated: 16 NOV 2000

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The user is advised to check the PowerEvolution Network for the latest information.